

Reconsidering the *Lepidorhombus whiffiagonis* in VIIIc&IXa stock boundaries

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Introduction

The genus *Lepidorhombus* is represented in eastern Atlantic waters by two species, megrim (*L. whiffiagonis*) and four-spot megrim (*L. boscii*). Four stocks of megrims are assessed by ICES: megrim in ICES Subareas IV and VI, megrim in Divisions VIIb-k and VIIIabd, megrim in Divisions VIIIc and IXa and four-spot megrim in Divisions VIIIc and IXa.

The stock of *Lepidorhombus whiffiagonis* in VIIIc&IXa is analytical assessed in the ICES working group for the Bay of Biscay and the Iberian Waters Ecoregion. The other assessed species of Genus *Lepidorhombus* in this area is *L. boscii*. There is a common TAC for both species of megrim (*L. whiffiagonis* and *L. boscii*), so the joint status of the two species should be taken into consideration when formulating management advice.

It should be taken into account that megrim, *L. whiffiagonis*, is caught in mixed fisheries. Megrim are by-catch in mixed fisheries generally directed to white fish. Therefore, fishing mortality of megrims could be influenced by restrictions imposed on demersal mixed fisheries, aimed at preserving and rebuilding the overexploited stocks of southern hake and *Nephrops* (ICES, 2014). Managing according to a very low F (fishing mortality) for megrim could cause serious difficulties for the exploitation of other stocks in the mixed fishery (choke species effect). Both Iberian megrim stocks are assessed separately but managed together, situation that may produce inconsistencies when these stocks are considered in a mixed fisheries approach (ICES, 2014).

Southern megrim

Ecosystem aspects (from the Stock annex, ICES 2015)

Megrim presents highest abundance in Division VIIIc (Sánchez et al., 2002). There is a certain bathymetric segregation between the two species of megrim. *L. boscii* has a preferential depth range of 100 to 450 m and *L. whiffiagonis* of 50 to 300 m (Sanchez et al., 1998).

Megrim appears to show a gradual expansion in its bathymetric distribution through their lifetimes with the larger individuals tending to occupy shallower waters than the juveniles. Bearing in mind that the two species have similar characteristics, a certain degree of interspecific competition may be assumed (Sanchez et al., 1998). Juveniles of these species feed mostly on detritivore crustaceans inhabiting deep-lying muddy bottoms. Adults *L. whiffiagonis* are more ichthyophagous and rates of crustacean in diet decrease with fish size (Rodriguez-Marín, 2002).

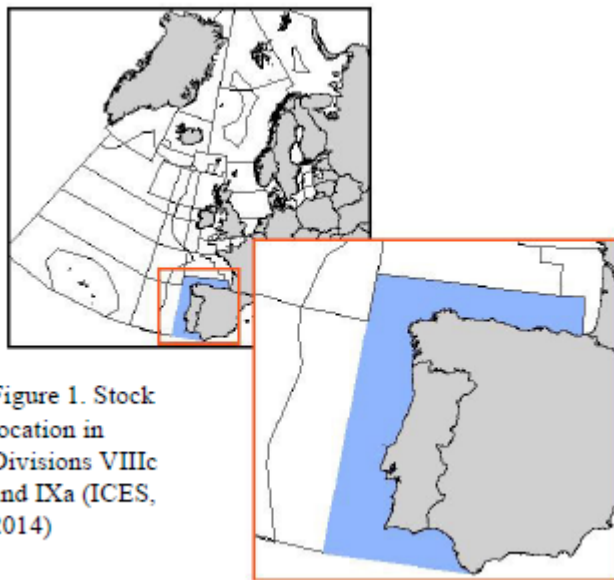


Figure 1. Stock location in Divisions VIIIc and IXa (ICES, 2014)

The spawning period of this species in VIIIc&IXa is from January to April, being later than in the northern area, where mature males can be found from November to March and mature females from December to March, but spawning peaks in March (BIOSDEF, 1998; study contract 95/038).

The growth rate also varies (Landa et al., 1996), growth is quicker in the southern area but the maximum length attained is smaller than in the north. The

maximum age for megrim also varies with latitude. In Subarea VII the maximum age of megrim is 14 years, this decreases to 12 years in Divisions VIIIc&IXa (BIOSDEF, 1998; Landa et al., 2000). This latitudinal variation in growth, with a greater age range and maximum lengths in the north (Division VIIchjk), intermediate in the Bay of Biscay (Division VIIIa,b,c2), less in the north of the Galician continental shelf (Division VIIIc1) and least in the south of the Galician continental shelf (Division IXa2), where the species is very scarce (Landa et al., 2000), can sustain the existence of several populations but does not justify the division in stocks.

Basis for current stock definition

The boundaries of the stocks were established only for management purposes.

Genetic information

Genetic studies on 16S rDNA gene from several samples from the Atlantic area showed that there is not a clear differentiation between the northern and southern stocks considered by ICES (García-Vázquez et al., 2006). The same authors concluded in 2009 that there are two populations of *L. whiffiagonis* in the Atlantic, fishes from division VI

corresponded to one stock and those from divisions VIIIc and XI to a second one. However, the boundaries of these two stocks are not clear, VIIIabd was clustering with up North sample (VI), whereas samples from area VII clustered with South ones (Danancher and García-Vázquez, 2009). As no further results have been found, it is difficult to determine if finally the southern stock is more like VIIIabd division, VII division or both. Detailed investigations in order to describe megrim population structure are needed.

State of the stock

Commercial catch data

Estimates of landings, discards and catches of the WGBIE (ICES, 2015) for the period 1986 to 2014 are given in Table 1, extracted from the working group report. The highest historical value in landings was reached in 1990, followed by a steady decline to 117 t in 2002. Since then, some increases and decreases in landings has been observed till 2010 were the lowest value of the entire series occurred. Since 2011, the stock is increasing again, being 2011 and 2014 significant high values.

Table 1. Commercial catch data

Year	Spain landings			Portugal landings	Unallocated	Total landings	Discards	Total catch
	VIIIc	IXa*	Total	IXa				
1986	508	98	606	53		659	46	705
1987	404	46	450	47		497	40	537
1988	657	59	716	101		817	42	859
1989	533	45	578	136		714	47	761
1990	841	25	866	111		977	45	1022
1991	494	16	510	104		614	41	655
1992	474	5	479	37		516	42	558
1993	338	7	345	38		383	38	421
1994	440	8	448	31		479	13	492
1995	173	20	193	25		218	40	258
1996	283	21	305	24		329	44	373
1997	298	12	310	46		356	52	408
1998	372	8	380	66		446	36	482
1999	332	4	336	7		343	43	386
2000	238	5	243	10		253	35	288
2001	167	2	169	5		175	19	193
2002	112	3	115	3		117	19	137
2003	113	3	116	17		134	15	148
2004	142	1	144	5		149	11	159
2005	120	1	121	26		147	19	166
2006	173	2	175	35		210	16	226
2007	139	2	141	14		155	0.4	155
2008	114	2	116	17		133	11	144
2009	74	2	77	7		84	11	94
2010	66	8	74	10		83	5	88
2011	242	0	242	34	26	302	69	371
2012	151	11	161	18	83	262	31	293
2013	128	3	131	11	90	231	18	250
2014	225	5	231	30	116	377	23	399

Abundance indices from surveys

The annual Spanish survey (SpGFS-WIBTS-Q4) is used to tune the model and covers the distribution area and depth strata of this species in Spanish waters. This survey is considered a good abundance index, the figure 2 indicates that the survey is quite good at tracking cohorts through time. In figure 3, the time series of the index is shown. The values during the period 1988 – 1990 were the highest, followed by a declining trend till 2011, a general increasing trend is occurring since then in accordance with the same trend in landings.

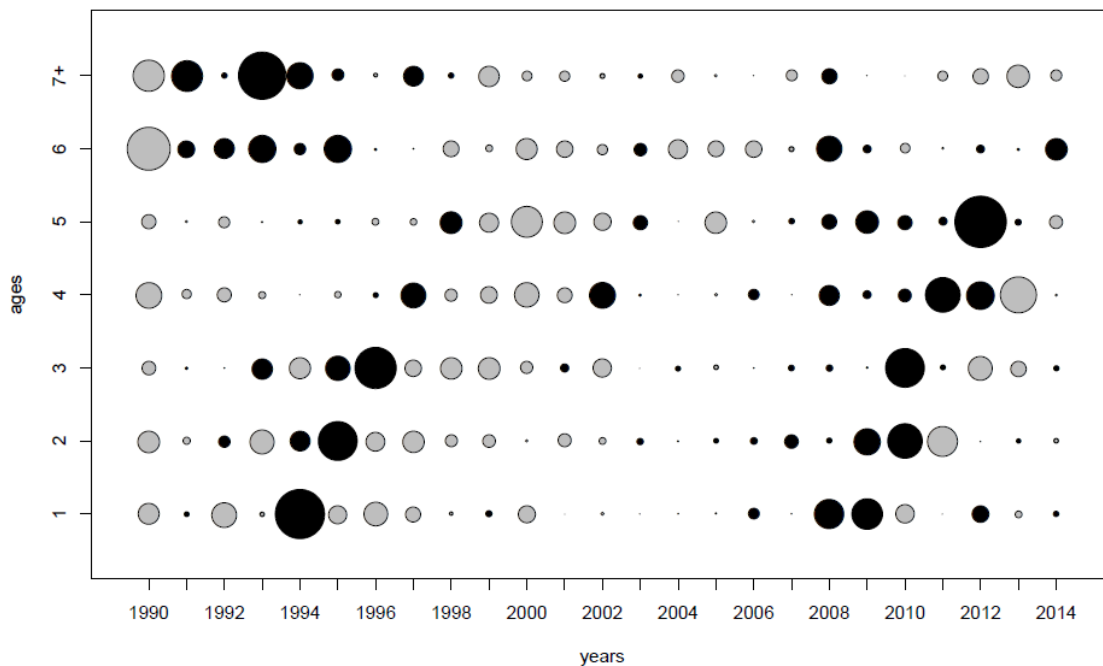


Figure 2. Standardized log (abundance index at age) from survey SPGFS-WIBTS-Q4 (black bubbles means <0) (ICES, 2015)

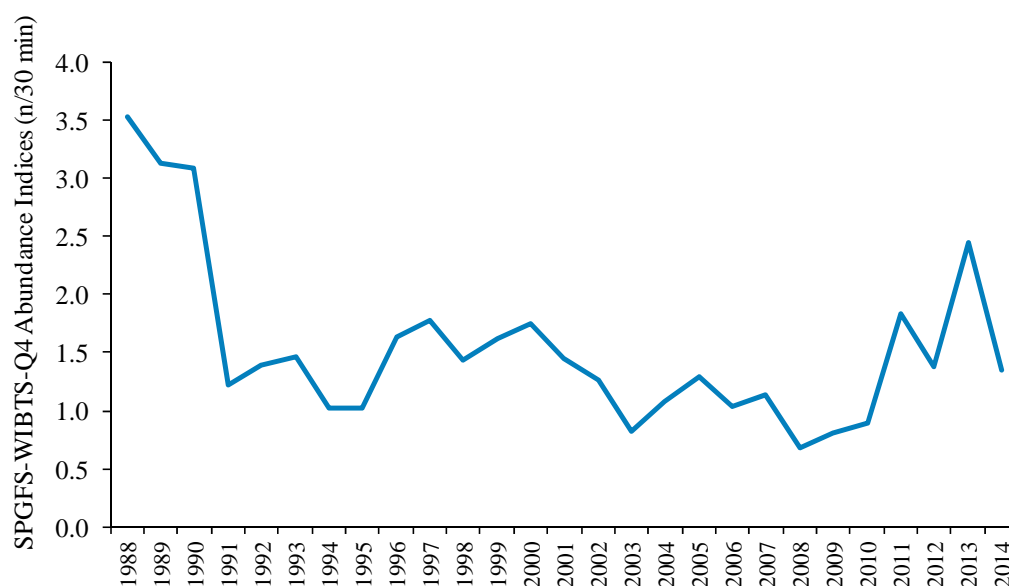


Figure 3. Spanish survey Abundance Index in VIIIc&IXa (ICES, 2015)

Figure 4 shows that the spatial distribution of megrim from survey data, being more abundant in VIIIc than in IXa, and around the 300 m of depth. The increase in abundance in the last four years is also reflected in the spatial distribution.

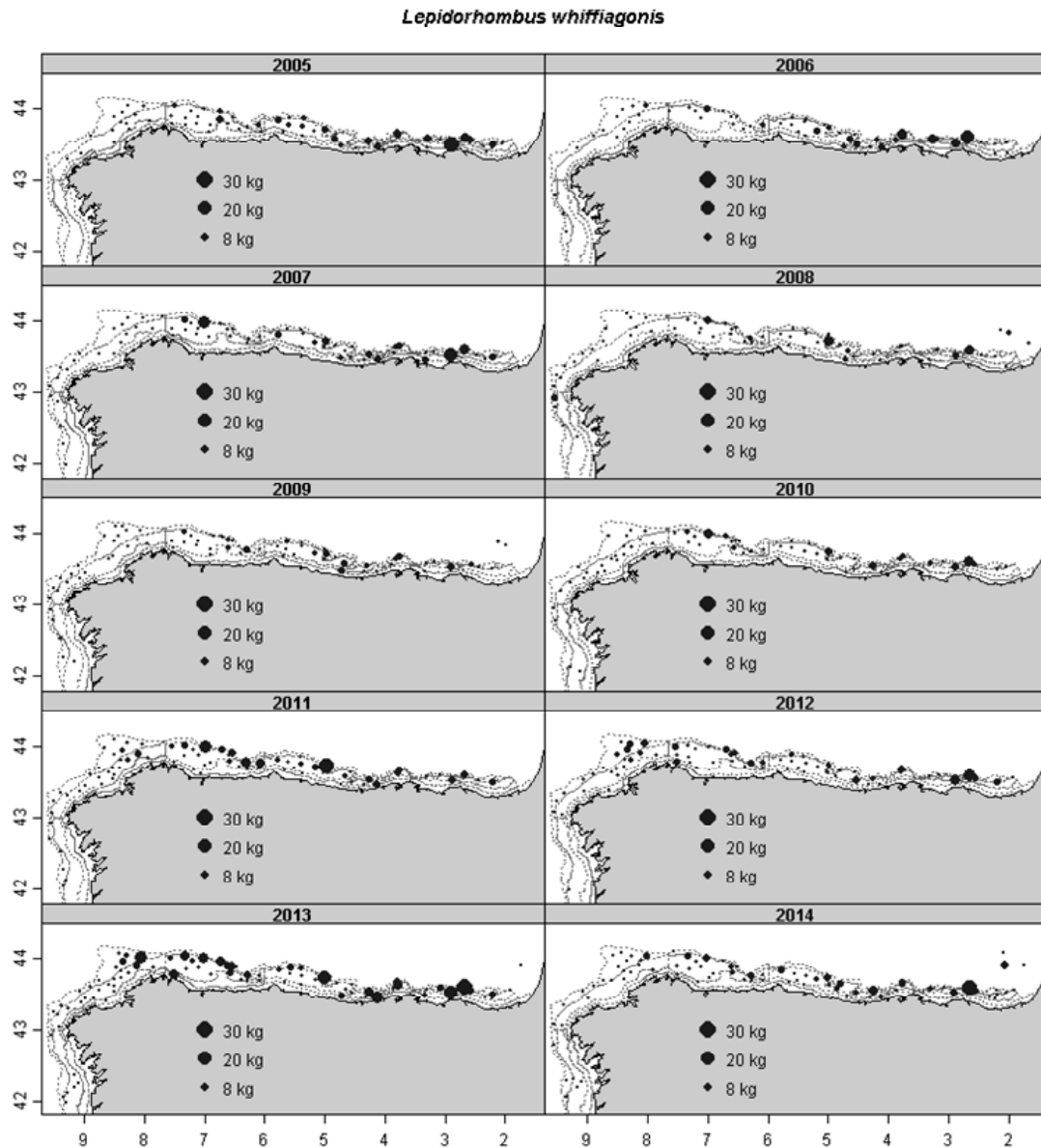


Figure 4. Distribution of megrim biomass in Spanish demersal surveys between 2005 and 2014.

Commercial fleets used in the assessment to tune the model

The majority of the catches of this stock are taken by Spanish bottom trawlers (Castro et al., 2011). Two Spanish commercial tuning fleets of bottom otter trawl targeting demersal species are used to calibrate the model. Avilés port bottom otter trawl targeting demersal species shows a higher LPUE for this species in relation to A Coruña

port. One of the reasons could be that the area where Avilés fleet operates, matches more with the spatial distribution of megrim. A Coruña index is more or less stable at low levels and Avilés index presents a general decreasing trend.

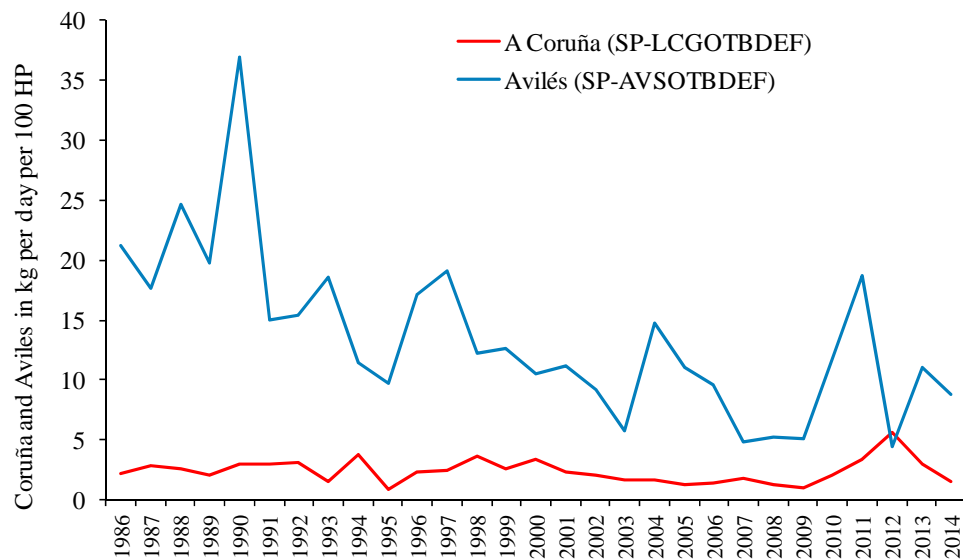


Figure 5. Commercial Abundance Indices in VIIIc&IXa (ICES; 2015)

Additional information

Table 2. Landings of megrims in VIIIc& IXa and TAC.

Year	<i>L. whiff</i>	<i>L. boscii</i>	Combined megrims	
			Landings	TAC
1986	659	1124	1783	
1987	497	1688	2185	13000
1988	817	2223	3040	13000
1989	714	2629	3343	13000
1990	977	1945	2922	13000
1991	614	1682	2296	14300
1992	516	1916	2432	14300
1993	383	1384	1767	8000
1994	479	1403	1882	6000
1995	218	1652	1870	6000
1996	329	1098	1426	6000
1997	356	896	1252	6000
1998	446	1123	1569	6000
1999	343	1125	1468	6000
2000	253	1041	1294	5000
2001	175	931	1105	5000
2002	117	720	837	4000
2003	134	876	1009	2400
2004	149	1006	1155	1336
2005	147	983	1130	1336
2006	210	1092	1302	1269
2007	155	1104	1259	1440
2008	133	980	1113	1430
2009	84	1134	1218	1430
2010	83	1297	1380	1287
2011	302	1128	1430	1094
2012	262	952	1214	1214
2013	231	931	1163	1214
2014	377	1154	1531	2257

The percentage of megrim in total catch of both species in the area, varies from 6% in 2010 as the minimum, to 37% in 1986 as Table 2 shows. The last four years, this percentage is around 20%.

The Northern megrim stock, in Divisions VIIb-k and VIIIabd, borders the Southern stock. Landings in 2013 were 15809 tonnes,

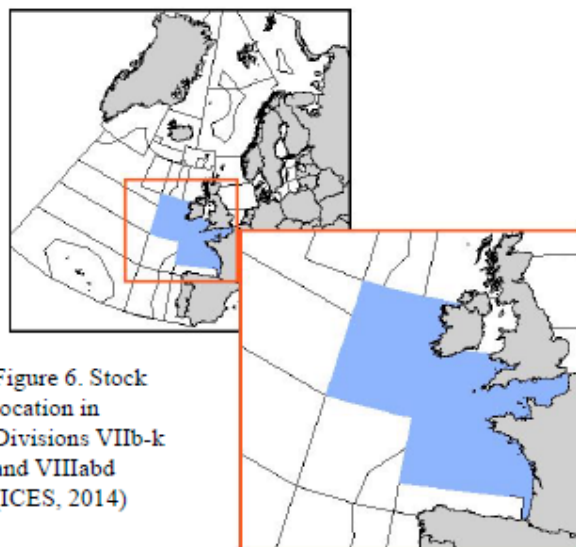


Figure 6. Stock location in Divisions VIIb-k and VIIIabd (ICES, 2014)

Conclusions

This is a small stock with an average stock SSB since 1986 of 1300 t (ICES, 2014).

The two megrim species (*L. whiffiagonis* and *L. boscii*) are not separated in the landings, the advice of the two stocks is linked. To get fishing mortality for both stocks at or below F_{MSY} , the F multiplier of the species in worst situation is applied to both stocks (ICES, 2014). In one hand, this election may result in loss of yield from the stock that is in better condition and in the other, this could have a choke species effect in the exploitation of other stocks in the mixed fishery (ICES, 2014). In fact, this effect was observed in the results of the mixed fisheries analysis developed for Iberian stocks by the working group in mixed fisheries WGMIXFISH_METH (ICES, 2013).

Working group WGBIE considered that this stock could be just “the tail” of the much larger stock of megrim in ICES Subarea VII and Divisions VIIIabd. One suggested option from this group was to reconsider the stock limits and the inclusion in the Northern megrim stock (ICES, 2014).

The question is whether this inclusion will ensure that the choke effect does not occur and that this measure compensates the added difficulty to the management of the two species in the area.

Experts’ opinion is requested to deal with these issues, taking into account that deeper studies, at least in biological and genetic aspects of the species, are needed to make a decision.

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